Impact of oil effluent on the enzyme activity in blood serum of freshwater food fish *Cyprinus carpio*

C. Kamaraj[1], and *K. Thamilmani[2]

FT PhD Research Scholar[1], Assistant Professor[2]
PG and Research Department of Zoology, Arignar Anna Government Arts College
Musiri, Tiruchirappalli – 621 211, Tamil Nadu, South India

Abstract: The present study was to estimate the acute toxicity of oil effluent on *Cyprinus carpio* and to evaluate the lethal levels. The 120 hrs median lethal concentration of oil effluent were found to be 80ppt for *Cyprinus carpio*. Furthermore experiments were continued with sub lethal concentration of (1/10th conc. of LC_{50}) oil effluent which were evaluated from the LC_{50} value. After treatment the fishes were reared in ideal condition, then sacrificed dissected at different predetermined interval during the accumulation period, (i.e.) 1st day to 20th day, during the depuration period from 1st day to 15th day for *Cyprinus carpio* in oil effluent treatment for assay studies. The present study also show that oil effluent causes considerable modifications in enzyme activities and likely to induce tissue damage in *Cyprinus carpio*. Hence, this effluent should be handling with care and avoid its access into aquatic environment.

***Index Terms*:** Oil effluent, *Cyprinus carpio*, SGOT and SGPT.

I. INTRODUCTION

Fish constitute a valuable commodity from the standpoint of human consumption; aquatic pollution undoubtedly affects fish health and survival. Heavy metals are common contaminants of the aquatic environment because of their persistence and tendency to concentrate in aquatic animals (Hoo et al., 2004; Ayas et al., 2007; Kumar and Achyuthan, 2007; Shukla et al., 2007; Verma and Srivastava, 2008a; Srivastava and Verma, 2009). Most heavy metals discharged into the environment find their way into the aquatic system as a result of direct input atmospheric deposition and erosion due to rainwater. Hence, aquatic animals are often exposed to important levels of heavy metals. Zinc is an important heavy metal and it plays a significant role in different biological processes including oxidative phosphorylation, gene regulation and free radical homeostasis as an important cofactor (Feder, 1996). Though, when its concentration exceeds metabolic supplies it becomes toxic (Gupta and Srivastava, 2006; Srivastava et al., 2006 ; Srivastava, 2007; Srivastava and Verma, 2009).

Fish are particularly sensitive to environmental pollution of water and therefore, contaminants may drastically damage certain physiological and biochemical processes when they enter the organs of fishes (Waite et al., 1992; Srinivas Reddy et al., 1983; Mahttiessen et al., 1995). Bioaccumulation of pesticides and heavy metals in tissues of aquatic organisms (Elia et al., 2006) can be more harmful for human consumption.

Toxicity appears when we take in more than we can utilize and eliminate. Toxic substances can be a real problem, since after years of exposure to these substrates; the body's ability to eliminate them can slow down. They can get recirculated into the bloodstream or accumulate in the liver body fat or other parts of the body. These types of build-ups and problem through the whole body can provide to the development of serious illness.

Enzymes are a creation of the nature planned to accelerate and control various chemical reactions in a specific manner that decide the metabolism and very important activities of a cell and thus of an organism. But, the orderly balance in the physiological progress is constantly under attack by the environmental adversities. The study on the disorder in enzyme activities with respect to a change in environment makes the beautiful index of stress, therefore, could be due to this reason enzyme analysis is becoming increasingly significant for the determination of toxic effects of chemical contaminants in the field of environmental toxicology (Isreal Stalin and Sam Manohardas 2012).

Alanine amino transaminase (ALT) or Serum Glutamic Pyruvic Transaminase (SGPT) and aspartate amino transaminase (AST) or serum glutamic oxaloacetic transaminase (SGOT) contained enormous amounts in hepatocytes (Latu 1991). SGOT is sensitive indicators of the liver cells damage. SGOT are cytosolic enzymes, whereas SGPT is microsomal enzymes, together with enzymes rise caused by viruses, drugs and toxic, and will discharge into the blood when the liver is damaged. Serum Glutamic Pyruvate Transaminase (SGPT) is an enzyme there in the cell liver. Its function is to alter the compound into an alfaketoglutarat aspartate and oxaloacetate and glutamate (Heinicke 2000). Another case when the spoiled cells liver and the walls are broken, SGOT and SGPT are going out of the cell and into the bloodstream. As a result, the levels of SGOT and SGPT that there should be no or low in the blood becomes high which can cause liver cells damage together with viral hepatitis, fatty liver, drug toxicity.

The liver reduces ibuprofen from the body. The procedure may work too slowly in some people, or liver enzymes may be changed, by high doses of ibuprofen, mainly: glutamic pyruvic transaminase (SGPT) that catalyzes transmit of an amino group from alanine to a-ketoglutarate, the goods of this reversible transamination reaction being pyruvate and glutamate. Glutamic oxaloacetic transaminase (SGOT) - that eases the conversion of aspartate and alpha-ketoglutarate to oxaloacetate and glutamate, and vice-versa. Both enzymes are normally there in liver and heart cells. They are discharged into the blood when the liver or heart is spoiled, thus levels are raised with liver damage (viral hepatitis) or with an insult to the heart (heart attack).

Fish blood is usually taken via caudal vain blood chemistry estimates have been used to evaluate the health status of the most animal (Cav valho and Fernandes, 2006). For example, Serum Glutamic, Oxaloacetic Transminase (SGOT) and Serum Glutamic Pyruvic Transaminase (SGPT) are connected with hepatic pyrubic injury, acute injuries in trunk kidney, bacterial infection and myocardial infarction (Chen et al., 2004; Wells et al., 1986) reported that SGOT augmentations have a high activity in both fish gills and in cardiac tissue. Alkaline phosphatase (ALP) provides information about liver dysfunction (Wells et al., 1986).

The present investigation was proposed to appraise enzyme analysis in the blood samples of *Cyprinus carpio* at diverse exposure period of sublethal concentration (1/10th conc. of LC_{50}) of oil effluent. When observing the force of toxicity on fish, it is essential to know about the mechanism of detoxification also detoxification system in fishes seemed to point out that they were incapable of detoxification. Though, it was later confirmed that some fish species could detoxify xenobiotics and that toxicity of several xenobiotics could be correlated to conjugative metabolic activity (Buchler, 1996; Lech, 1974).

Materials and Methods

Collection of Experimental Animal

The fish, *Cirrhinus mrigala* (Length 10.3 ± 0.002cm, Weight 9.8 ± 0.003 g) fresh water food fish were segregated and obtained from Karanthai (Golden Fish Farm) farm, Thanjavur, Tamil Nadu, India and were transported in aerated polythene bags to the laboratory. The fishes were adapted to lab condition for 3 days before treatment with oil effluent.

Evolution of LC_{50} employing acute toxicity test

The purpose of this study was to test the acute toxicity of oil effluent on *Cyprinus carpio* and to appraise the lethal levels of oil effluent.

At first tentative experiment were carried out to fix the minimum concentration of oil effluent to obtain maximum mortality for *Cyprinus carpio* over 120 hour's duration. After confirming the minimum concentration, identified size of *Cyprinus carpio* were located in different tubs (each group consists of 6 animals in 10 litre capacity plastic tubs) and exposed to different concentration of oil effluent which ranges from 10 ppt – 80 ppt at an interval of 5 ppt for *Cyprinus carpio* for a period of 120 hour. Besides, control was also maintained simultaneously.

The Enzyme activities carried out under sub-lethal (1/10th conc. of LC_{50}) concentration in Blood serum. Serum Glutamic Oxaloacetic Transaminase and Serum Glutamic Pyruvate Transaminase in the serum was estimated by clinical kit provided by Biosystems Diagnostics Pvt. Ltd., Tamilnadu (India).

Results

Acute toxicity LC_{50}

The 120 hrs median lethal concentration of oil effluent on *Cyprinus carpio* was found to be 80 ppt. In the current research, mortality was observed in the control tubs for the entire duration of the experiment. Oil effluent is much more toxic than the organic compounds and one has readily taken up by the tissue of aquatic animals.

These acute toxicity tests proposed that *Cyprinus carpio*, is sensitive to oil effluent and the caused death might be the result of difficulties in gas exchange in the gills as well as the lethality of oxidative metabolism. Hence, biotransformation and antioxidant enzymes were expected to play the main role in the removal of xenobiotic compounds.

During the experimental period, the fishes were restive antagonistic and have the tendency to leap out of the tubs (struggle for existence). This may be due to the suffocation out of oxygen deficiency. Secretion of mucus in the gill chamber should the lesions in gills of fishes.

Serum Glutamate Pyruvate Transminase (SGPT)

Table 1 & Fig. 1 symbolize the level of SGPT in response to oil effluent in serum of *Cyprinus carpio*. The mean values of control were found to be 78.33±6.02 U/L.

During the accumulation period, the mean values were found to be augmented significantly from 1st day to 20th day. For 1/10th conc. of LC_{50}, the mean values 118.33±4.16 U/L at 1st day to 208.66±4.50 U/L at 20th day. During the depuration period, the mean values were found to be reduced significantly from 1st day to 15th day. For 1/10th conc. of LC_{50}, the mean values were 207.66±3.05 U/L at 1st day to 122.66±4.50 U/L at 15th day.

Serum Glutamate Oxaloacetate Transminase (SGOT)

Table 1 & Fig. 2 represent the level of serum glutamate oxaloacetate transaminase in replied to oil effluent in serum of *Cyprinus carpio*. The mean values of control were found to be 58.66±6.50 U/L.

During the accumulation period, the mean values were found to be increased considerably from 1st day to 20th day. For 1/10th conc. of LC50, the mean values 92.33±3.51 U/L at 1st day to 189.33±3.31 U/L at 20th day. During the depuration period, the mean values were found to be decreased considerably from 1st day to 15th day. For 1/10th conc. of LC50, the mean values were 192.66±4.16 U/L at 1st day to 82.66±3.51 U/L at 15th day.

Table 1: The level of SGPT and SGOT content alterations in the blood serum of *Cyprinus carpio* during accumulation and depuration period of sublethal (1/10th conc. of LC50) concentration of oil effluent.

S.No	Days	Blood samples	Control	Experiments	
				Accumulation period	Depuration period
1	1st day	SGPT	78.33±6.02	118.33 ± 4.16	207.66 ± 3.05
		SGOT	58.66±6.50	92.33 ± 3.51	192.66 ± 4.16
2	5th day	SGPT	78.33±6.02	153.33 ± 3.05	185.66 ± 2.08
		SGOT	58.66±6.50	122.66 ± 7.02	166.66 ± 4.50
3	10th day	SGPT	78.33±6.02	179.33 ± 5.50	147.66 ± 6.11
		SGOT	58.66±6.50	144.66 ± 2.51	126.33 ± 5.50
4	15th day	SGPT	78.33±6.02	184.66 ± 9.71	122.66 ± 4.50
		SGOT	58.66±6.50	174.33 ± 3.05	82.66 ± 3.51
5	20th day	SGPT	78.33±6.02	208.66 ± 4.50	
		SGOT	58.66±6.50	189.33 ± 3.31	

Fig. 1 The Level of Serum Glutamate Pyruvate Transminase in the Blood Samples of *Cyprinus carpio* during accumulation and depuration period of sublethal (1/10th Conc. of LC_{50}) concentration of oil effluent

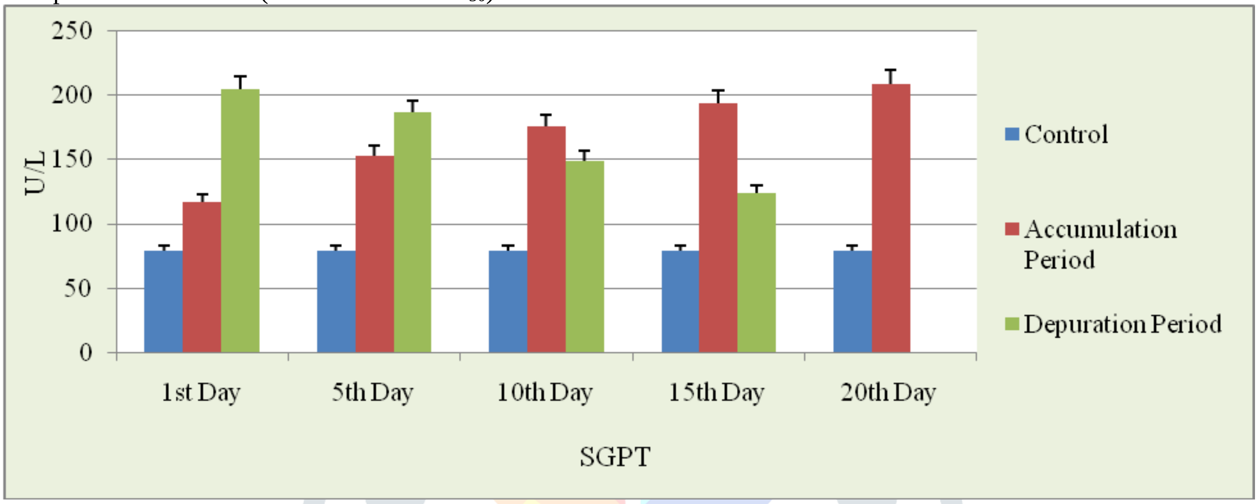
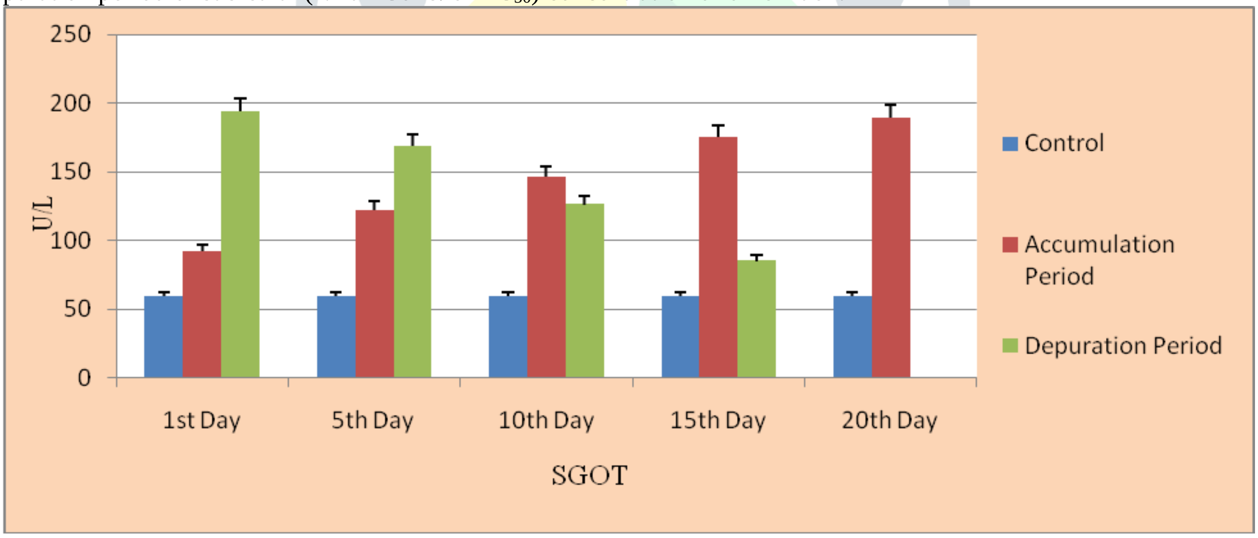


Fig. 2 The Level of Serum Glutamate Oxaloacetate Transminase in the Blood Samples of *Cyprinus carpio* during accumulation and depuration period of sublethal (1/10th Conc. of LC_{50}) concentration of oil effluent



Discussion

The *Cyprinus carpio* exposed to sublethal (1/10th Conc.) of oil effluent, the blood samples were analyzed in blood serum, the ongoing improved activity of SGPT and SGOT is observed in the blood samples. (118.33±4.16 U/L at 1st day to 208.66±4.50 U/L at 20th day 92.33±3.51 U/L at 1st day to 189.33±3.31 U/L at 20th day) respectively. A similar observation was made by that increase of SGOT and SGPT activity in blood after exposure to the oil effluent in *Cirrhinus mrigala* (Valarmathi, 2004).

This observation connected with the results of Khan (1991) who observed the excessive secretion of mucus in the gills of longhorn scupin fish when exposed to Oil contaminated sediment. The 120 hrs median lethal concentration of oil effluent were found to be 80ppt for *Cyprinus carpio*.

Many aquatic contaminants have found to be toxic to fishes (Holden, 1972) and many authors investigated have been made to toxic chronic toxicity of such contaminants. (Foster and Crosby 1987) have studied that high accumulation of these xenobiotic compounds further goes oxidative activation in the fishes. Metabolism of these by-products is more toxic than its parent compounds. Therefore it is considered threat metabolites of this oxidative activation may fetch mortality in *Cyprinus carpio* when exposed to oil effluent.

Similarly, Ghorpade, et al., (2002) have observed an increase of GPT and GOT activity in muscle and liver after exposure to diethyl phthalate (DEP) on a freshwater fish, *Cirrhinus mrigala*.

An increase in SGOT and SGPT has been observed in *Cyprinus carpio* (Mathan, 2006), *Sparus auratai* (Antonella and Landriscina, 1999), *Carassius auratus gibelio* (Zikic et al. 2001), *Cyprinus carpio* (De la Torre et al. 2000) and *Clarias gariepienus* (Velmurugan et al. 2006) after exposures to different metals. Mathan (2006) reported that amplification of these enzymes may have resulted from tissue harm and amplified synthesis of the enzymes to defend against stress. Antonella and Landriscina (1999) also recommended that cadmium modifies hepatocyte cell membrane structure and concomitantly persuades changes in mitochondrial membranes resulting in elevation of these enzymes.

Augmentation in SGOT has been observed in liver disease of humans particularly under hepatocellular condition and increase in serum transaminases levels is associated to the rate and extent of liver cell necrosis. SGOT is found in liver cells with SGPT and the latter is cystolic enzyme whereas the former is mitochondrial. They are released into serum on cell harm. SGPT levels enlarge in toxic hepatitis and viral hepatitis has described changes in biochemical components of the blood and liver of *Clarias batrachus* under carbaryl influence where SGOT and SGPT values amplify in experimental fish and augment in the activities of transaminases is due to pesticide intoxication which suggests improved protein catabolism and probable hepatocellular spoil in the organism.

SGPT and SGOT are enzymes liberated into the blood in pathological conditions and therefore are of clinical importance and their presence in blood plasma can give information on tissue injury or organ dysfunction. Serum alkaline phosphatase augments after exposure to different concentrations of carbaryl. Rise in ALP in serum designates intrahepatic cholestasis. No major changes in the activities of ALP in control and experimental fish (*Cyprinus carpio*) under diazinon effect have been reported. A decrease in the activities of alkaline phosphatases in Channa punctatus have been studied and according to these scientific providers, the alkaline phosphatase activity is inhibited after 96 hr exposure and steadily recover its normal values or sometimes even an amplified activity experimented.

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